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JULY 1953

VOLUME 28 • NUMBER 7

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JAMES J. FINN, *Editor*

Volume 28 JULY, 1953 *Number 7*

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MONTHLY CHAT

IN ORDER to put an end to the conflicting claims and confusion concerning the merits of the various 3-D and wide-screen systems, Saul E. Rogers, an attorney connected with the motion picture field, recently suggested that the industry unite in organizing a competently staffed research bureau which would pool the knowledge and skills of scientists working within the industry, and also make use of the research facilities of important technical schools and universities.

This research bureau would be supported by the contributions of the industry as a whole; all would profit in terms of standards and exact information about what could and could not be expected from the new processes instead of being confused by extravagant statements.

Even more important, the entire industry would then have the satisfaction of knowing that the best scientific brains had been brought together to develop and improve the photographic, projection and sound recording processes which are the lifeblood of motion pictures.

It was only as a last resort, when many theatres were closing or half empty, that the producers even bestirred themselves to investigate the technological developments that had been available for years. As long ago as 1948, IP commented on this situation editorially. In January, 1949, we stated:

"Three-dimensional pictures, stereophonic sound, and greatly improved color processes are but three of the advances long promised by the film industry. But it begins to look as though the big brass have become very coy about putting money into technological developments on behalf of an industry which, while the source of their opulance and power, might possibly be in for a bit of rough going."

It was noted by Mr. Rogers that in every important industry in which there is a scientific application of the knowledge of chemistry, electronics, electricity, optics or similar sciences, there has been established a highly efficient research organization to which the problems involved in the industry can be submitted for general research, observation and analysis. "It seems *amazing*," he noted, "that the film industry, one of the most important in the nation . . . has never established such a bureau."

IP also thinks that this situation is amazing. The lack of an industry-wide research bureau is a good example of the shortsighted, selfish outlook that has a lot to do with the dangerous and confusing position the motion picture industry finds itself in today.

Confusion Says-

Natural Vision?
Columbia 3-D?
Vitascope?
Tru-Stereo?
RKO Radio 3-D?
Stereo-Cine?
CinemaScope?
20TH-Fox 3-D?
Zeiss-Ikon 3-D?
Todd-AO Wide Screen?
Metrovision?
Paravision?
Polaroid 3-D?
Regiscope Wide-Screen 3-D?
U-I 3-D?
Warner 3-D?
Cinerama?

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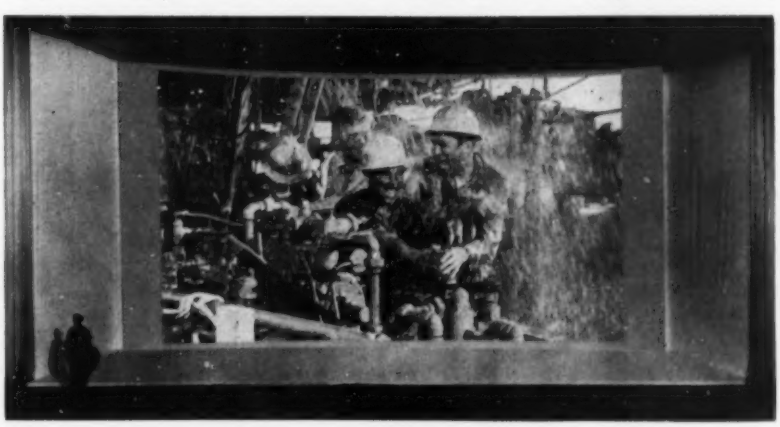
VOLUME XXVIII JULY, 1953 NUMBER 7

Round-Up of the Wide-Screen Process

This article and the accompanying illustrations present a detailed picture of the new wide-screen process from cameraman to projectionist, covering the methods used for filming pictures so that they are adaptable both to wide-screen and standard projection.

DURING the past few months the industry has been deluged with rumors about new aspect ratios, and projectionists have probably heard a great many conflicting stories about the screen proportions of pictures now in preparation at the various Hollywood studios. Also, right in the projectionists' home territory, the theatre, there is a movement on to convert the standard-size pictures now in release to the larger wide-screen size by a process of masking apertures and using shorter focal-length lenses.

To help clear up some of this confusion — it can't be entirely cleared up just yet because the studios have not agreed on standards — IP is reproducing a group of illustrations and some excerpts from a recent article by Arthur Gavin in the *American Cinematographer* covering wide-screen developments at the Hollwood studios. Also included here are some other observations on the subject that will be of particular interest to projectionists.



CURVED WIDE SCREEN developed by Universal-International studio is metallic-surfaced to intensify brilliance of projected picture, both wide-screen and 3-D. Scene is from U-I's "Thunder Bay," first wide-screen release in Technicolor. Paramount and MGM have developed similar screens.

Most members on the craft, particularly the older ones, will remember that controversy over the proper aspect ratio is not a new thing in the film industry. When sound was introduced, for instance, the addition of the sound track reduced the width of the standard 4 by 3 aspect ratio, resulting in a virtually square picture. Studio directors screamed that the square shape was a stifling handicap to composition and group action.

Projectionists Took Over

While the directors complained, projectionists and exhibitors went into action on their own and restored the screen image to its former proportions by reducing the height of the projection aperture and expanding the picture with a one-half inch shorter focal-length lens. Of course, the smaller aperture sometimes scalped the heads and amputed the feet of performers, but this was considered a small price to pay for a rectangular screen.

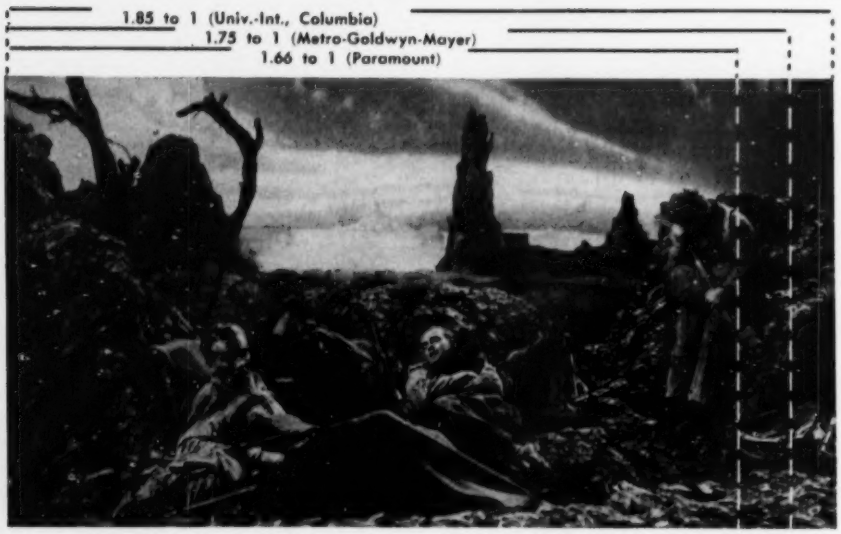
It was pointed out recently by Herbert Barnett, president of the SMPTE, that back at the turn of the century big-screen and road-show pioneer Ly-

NORMAL — For comparison, a scene from a current Hollywood production is pictured above and below in three different formats. Here it is shown in the conventional 1.33 to 1 aspect ratio, long the industry standard.

man Howe roamed the country shooting and projecting his film with wide-angle lenses. The Lumiere brothers built and used a spectacular 98-foot screen at about the same time. During the twenties and thirties, there were any numbr of experiments with large wide-screen pictures such as the Fox "Grandeur" process and Paramount's "Magnafilm." Both of these, however, were based on the use of a wider film, 70-mm in the case of Grandeur.

Columbia's 4-Way Camera

A good example of present Hollywood thinking would be the recent announcement by Columbia that it had developed and put into use a "new 4-way camera which will shoot simul-



WIDE-SCREEN

The same scene given the new aspect ratio of 1.85 to 1, which has been adopted as standard by Universal-International and Columbia studios. Dotted lines define aspect ratios adopted by two other studios as would apply to same scene.

CINEMASCOPE—The same scene as it would be photographed and screened in the new ultra-wide-screen CinemaScope process. Of the three methods illustrated, only the latter requires special lenses for camera and projector. Special metallic-surfaced screens are employed in showing all wide-screen as well as three-dimensional films, because wide-screen demands maximum illumination and reflectance.

. . . And the sound was all around
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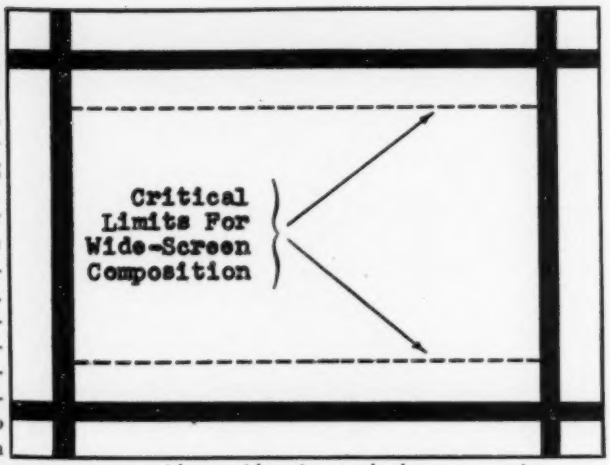
taneously 2-D, 3-D, 2-D wide-screen, and 3-D wide-screen." Both within and without the industry, this statement created much speculation as to just what sort of "magic" camera this studio had contrived.

Actually, what Columbia's technical men had done was discover that almost any conventional motion picture can be given pleasing wide-screen presentation simply by projecting it with a wide-angle lens and masking it down top and bottom to give the projected picture a wider format. This, of course, applies to both 2-D and 3-D



PATTERN of typical ground-glass on Mitchell camera finder, with new wide-screen masking (dotted lines) added. Heavy lines define standard Academy aperture. In masking finder for wide-screen composition colored plastic is used so cameraman can view and compose scene with consideration to both aspect ratios.

Transition Problems

This all-purpose system is also being used by Paramount, Universal-International and Metro-Goldwyn-Mayer. The transition from standard to large wide-screen pictures is creating a serious problem for exhibitors because once the current supply of "new style" pictures is in release, there won't be enough of the new-type film product to fill exhibitors needs, at least for some time to come. This means that standard 2-D films must be shown in competition with pictures in the new format. At the same time, each major studio has a backlog of unreleased 2-D pictures, the market value of which stands to be seriously affected as the trend to stereo and wide-screen films gains impetus throughout the country.

Then studio engineers found that most backlog films could be screened successfully in a wider aspect ratio, and the decision naturally followed to shoot all new productions with the newer wide-screen ratios in mind. To the cameramen this means composing scenes differently so that important detail or action will not be lost when the picture, usually photographed full-frame, is screened. The illustrations describe this process more fully.

Motion pictures made by Columbia and the other studios adopting the 4-way method are now composed essentially for wide-screen presentation, but at the same time there is harmonious composition extending to the full limits of the standard aperture frame. In the camera finder there is a special transparent mask (see illustration) which enables the cameraman to compose his pictures with both aspect ratios in mind. Thus all films made henceforth may be exhibited in either conventional format or wide-screen without the viewer being aware of any serious cropping of the overall scene.

IN THOSE STUDIOS where productions are being photographed so they may be screened on either normal or wide screens, new rules apply in composing each scene. Dotted lines above show the critical limits for wide-screen composition beyond which no action must extend. In this scene, should man telephoning suddenly stand, his head would be cut off by the masking during projection, unless operator moved camera upward to keep him below the dotted line.

Continuing Controversy

It is in the matter of aspect ratio — the relative height to width of the screen — that many of the studios are in disagreement. Opinion has ranged from 2 to 1 down to 1.5 to 1, excluding ultra-wide processes such as Cinerama and CinemaScope which are not being considered here. Eventually, standardization must come, but at present each studio believes its plan to be the correct one.

In the meantime, if a projectionist should change the proportions of any of the pictures now in circulation or any of the large backlog of 2-D films waiting for release, he may in some cases find that he has sliced off somebody's head or feet, but the studios claim that the change can be accomplished without any real damage.

What is needed are aperture plates of the desired proportion, the proper shorter focal-length projection lenses, and a large, metallic-coated, high-reflectivity screen. A large, wide picture can then be obtained. There are certain limitations, however, such as the structure of the theatre, strength of the light source, and graininess of the screen image when greatly enlarged.

How Much More Light for 3-D...Wide Screen?

When the screen found its voice more than a quarter century ago, the question, "How much will it cost?" was asked — if at all — from force of habit. Every showman knew he *had* to buy sound, just as he now sees the necessity for new equipment to handle the latest epoch-making projection techniques.

History Repeats

Exhibitors today are hurrying to exploit the terrific public interest in 3-D and wide screen showings — spending thousands and tens of thousands of dollars on new optics, screens, sound equipment . . . But what about screen lighting?

Light Losses Terrific

For 3-D and wide screen you need more light. *Much* more light. In almost every instance, *regardless of theatre size or present equipment*, you need ALL THE LIGHT YOU CAN POSSIBLY GET!

If that seems like a broad statement, just consider 3-D light losses, for example. Even with *two* projectors trained on the screen and with screens of much higher reflectivity than before, you give your patrons only about *half* as bright a picture as you previously furnished with conventional films!

Wide screen — same story. In this new medium, projection light is distributed over *2½ times the area* of ordinary screens.

New Equipment the Answer

To repeat — you need *all the light you can get*. This means NEW EQUIPMENT — equipment to operate the higher-capacity carbons at maximum currents.

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- **3-D stereophonic triple magnetic sound track**
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Visibility Factors in Projection

3. Color and Nature of Projection Light

By ROBERT A. MITCHELL

THE PRECEDING instalment in this series considered the picture-visibility factors of size of picture, shape of picture, brightness, and distribution of illumination. This concluding article examines in detail the color and nature of arclamp light and also covers other factors involved in the projection of a clear, sharp picture, such as surround illumination, contrast, image definition and steadiness of the picture.

A projection illuminant ought to be white. If it isn't white, the colors in natural-color films will be distorted. The screen should also be white, else the light reflected to the eyes of the audience will be tinted just as much as it would be if the light itself were colored.

But what is meant by "white"?

Color of Sunlight

The direct rays of the sun as they fall upon the earth through a dust-laden atmosphere are a slightly yellowish white. Light reflected down from the blue sky is definitely bluish white. Now, the *mixture* of slightly yellowish sunlight and blue skylight falling upon a freshly shaved block of colorless magnesium carbonate placed outdoors in the country at sea-level on a sunny day at 12 o'clock noon is a pure, neutral white. We call it pure, neutral white because that is what it looks to be. Scientists call it a whiteness of 6,500 degrees Kelvin (or Absolute), and designate a light-source of the same whiteness as Illuminant C. Noon sunlight alone has a color-temperature of 4,800 degrees Kelvin, and is designated as Illuminant B.

A tungsten-filament electric lamp burning at a rated voltage has a color-temperature of 2,850 degrees Kelvin. A light-source of this color (amber-white) is called Illuminant A. The low-intensity carbon arc is whiter than Illuminant A, but it is yellower than Illuminant B — noon sunlight without skylight. Low-intensity projection is therefore not "snow-white" projection. It cannot show off Technicolor, Ansco Color, etc. to best advantage. All color films for theatre use are "balanced," as they say, for the pure white light of Illuminant C.

The high-intensity carbon arc does not have a fixed color-temperature. The tint depends on the nature of the chemicals packed into the core of the positive carbon. Old-style HI trims for "straight" and Hi-Lo arcs gave a harsh, violet-blue light that made black-and-white movies look chalky and glaring — a bit too "cold" and "electric" to harmonize with the "human" qualities of movie drama. The color of present-day Tv images is similarly redolent of arctic snows.

"Pearlex" HI carbons, on the other hand, radiate a softer light for the projection of 16-mm color films, which are balanced for the Mazda lamp — Illuminant A. Pearlex goes to show how the color of HI arcs can be altered by clever chemistry.

The standard trims for modern HI projector arcs, however, are *pure* white, or very nearly so. That is, they correspond to Illuminant C, the mixture of noon sunlight and skylight which is the whitest white we know of. Since black-and-white films are printed on colorless-base stock, the audience will also be pure white, unless perchance the screen be dirty and yellowed with age.

Pure White Light

Strange as it seems, the pure white light of Illuminant C can be duplicated by mixing together any two colored lights of complementary colors — red and greenish blue, for example, or lemon yellow and violet-blue, or green and purple-red. If our white projection illumination be produced by mixing two complementary colors, with certain color-bands of the spectrum missing, certain natural-color films will not be reproduced with fidelity. Some colors will look too dark, others too bright, and some of them altered in hue.

We say *certain* natural-color films because different processes employ dyes having different spectral characteristics. The manufacturers of carbons, however, make sure that their carbons do not omit or overemphasize any wavelengths of visible radiation.

Light for Color Films

Except for the ever-present natural-color film, there is no objection to deviation from *pure* white projection light, providing that the deviation is in the right direction. The chalky appearance of light poor in red-orange rays and too rich in blue-violet rays has already been noted. Suppose, now, that we shift the color-temperature of our light away from the polar radiance of the iceberg and toward the cozy glow of the fireside. In other words, let's examine the effect of a lower color-temperature upon black-and-white projection.

Low-intensity arcs were not bright enough except for very small theatres, and they were more efficient producers of heat than of light. But in the little theatres where they could be used to supply adequate screen-illumination, projection was characterized by a chromatic softness and sturdy warmth that had two important advantages. It induced a kind of emotional empathy that made the screen a more humanized medium than it is under the harsh glare of the HI arc. It increased viewing comfort and picture-visibility by subduing the colder rays and increasing persistence of vision to a degree sufficient to minimize appreciably perception of shutter-flicker.

Silent pictures with a film-speed of 16 frames per second (shutter frequency of 32 cutoffs per second) would have been almost intolerable with HI illumination. That is, if clear-base positives were used for productions longer than 2-reel comedies.

Old-Time Tinted Stock

Old-time release-print practice took advantage of the dramatic subtleties of "hue." From 80 to 90% of all feature footage was printed on tinted-base stock. The colors most often used were tints of orange or amber. The choice of amber, the color by which movies can be viewed with a minimum of visual discomfort and eyestrain, can hardly have been mere

chance. Compared with the silent movies, modern motion pictures are stereotyped and coldly mechanical in both photography and presentation. The instrument for visual drama has degenerated into a mere machine.

The peripheral regions of the retina of the eye have much less persistence of vision than the central region, and they are much less sensitive to the warmer, redder rays than they are to the colder, bluer rays.

The retina is a light-sensitive screen containing two kinds of nerve-cells, some bearing cones and other rods. Direct vision is cone-vision, for the central region of the eye — the region of delicate and highly discriminative vision — contains only cones. The peripheral regions contain the rods. Now, cone-vision is most sensitive to yellow light of 580 millimicrons wavelength, while rod-vision has its sensitivity-peak at about 530 millimicrons in the green region of the spectrum. Rod-vision is *night-vision*, indistinct and utterly color-blind. Red objects appear black by dim moonlight, yellow objects gray, green objects white, and blue and violet objects gray. Rod-vision also extends for a short distance into the ultraviolet, invisible to the cones.

Rapid changes in brightness, however, are readily detected by the peripheral rod-vision; and since peripheral vision is blind to red but very sensitive to the shorter wavelengths, it can be understood why snow-white movies, if viewed from seats close to the screen, seem to flicker more than amber or yellow-tinted movies.

SURROUND ILLUMINATION

It has always been standard practice to mask motion-picture screens with black velour and to have the projected picture overlap the masking by an inch or so all around. The reason for this practice is twofold.

First, the masking hides the fuzziness of the highly magnified image of the aperture. Film picks up dust from the air, and some of the dust lodges upon the edges of the aperture and makes the boundaries of the projected image somewhat irregular. Second, the black masking provides a neat, sharp cutoff "frame" for the picture and remains in fixed position regardless of transient machine vibrations and slight differences between the two projector apertures which would become visible at changeovers.

As an incidental advantage, the contrast between the black masking and the projected photographic image creates a slight *apparent* increase in picture-brightness, especially around the edges where an increase is needed to help give the appearance of uniform illumination.

It has been found by experience that the sharp corners of the black-masked, rectangular screen are visually distracting and generally unpleasing. For this reason the corners of the screen are sometimes rounded, and round-corner projector apertures are used in conjunction with the special round-corner masking. The most pleasing results are obtained when the radius of the round corners is 1/16th the width of the screen.

The "Synchro-Screen"

In recent years noteworthy attempts have been made to substitute luminous masking for the conventional black, sharp-cutoff screen surround. In one type of luminous surround, the surround-brightness is maintained at a constant level. In a second, lighting is uniform, but is varied in luminosity to match the overall brightness of the projected picture. In a third, the surround-lighting is produced by the reflection of light from the screen upon a "cove" which surrounds the screen, and which is surfaced with essentially the same material as the screen. This type, represented by the RCA-Schlanger "Synchro-Screen," provides non-uniform lighting which corresponds with the tone and color of light and dark areas near the edges of the picture.

As illuminated masking goes, the simple and ingenious "Synchro-Screen" was considered as satisfactory as any. Because of the correspondence of the reflected light with light and dark areas in the picture, it created the illusion of a large, though vignetted, image. It also possessed considerable interest as a novelty. But it did not make pictures easier on the eyes. It extended peripheral flicker, and it decreased picture-visibility by reflecting light both back to the screen and into the eyes of the audience. This resulted in a haze which "softened" the picture by reducing contrast and washing out shadow-detail in all scenes having considerable areas of highlight. It also interfered with correct color-rendition in natural-color projection.

The black surround is still with us as a necessary adjunct to the presentation of motion pictures. It is neither beautiful nor ugly because, when pictures are being shown, it is invisible. Only the picture is visible; and that seems to this writer like a very sensible state of affairs. In fact, the dead black surround is the only type of screen masking which does not create a visual or a psychological stimulus of any kind. It thus cannot interfere in any way with the quality of the projected picture.

Auditorium Distractions

It is common knowledge that all visual stimuli should be absent from the immediate vicinity of a motion-picture screen. Reflections from the stage and proscenium should be minimized. Wall lights and illuminated clocks should be banished from the front of the auditorium. Necessary exit signs should be furnished with only a minimum of illumination.

In order to enhance the picture and to remove all possible sources of visual distraction, it is a common practice to paint the stage floor dead black in theatres having balconies. This prevents light from the picture from being reflected by the stage into the eyes of patrons seated in the balcony. The writer regards this extreme precaution as unnecessary, however.

The illuminated screen-surround seems already to have died as a live topic in projection technology. As a pretty novelty it has had its day; and attention is now being turned to panorama, stereoscopy, and other methods of audio-visual presentation which affect the intrinsic character of the motion picture to a profound degree.

PICTORIAL CONTRAST

Reduced to its bare essence, a picture is merely a conglomeration of areas having different brightness and colors. When these differences disappear, the picture disappears; and nothing remains but a blank surface. In black-and-white photography these differences are of brightness only, and comprise the factor called *contrast*.

If an adequately illuminated motion picture is projected in total darkness, the picture on the screen will reproduce the entire contrast-range of the photographic film, and will have maximum visibility if the illumination is strong enough to just perceptibly reproduce the blackest blacks as very deep grays.

If, during projection, extraneous

light is thrown upon the screen and gradually increased in brightness, a point will be reached where the blacks and darkest grays in the picture will appear the same. That is the point where contrast, and hence picture-visibility, begins to be reduced by the spill light. Further increases in the brightness of the extraneous light will destroy the medium grays. The lighter grays are next to disappear. Finally, even the bright highlights of the picture vanish as, for example, when direct sunlight falls upon a drive-in screen. At this point all perceptible contrast ceases to exist, and no picture can be seen.

Modern theatre practice advocates the use of moderately high levels of auditorium-illumination at all times in order that patrons find their way to and from their seats without breaking their necks, and also to humor the law in regard to the maintenance of "decorum."

In theatres where the auditorium light-level is not quite high enough to render the blacks and deepest grays of the picture indistinguishable from each other, it might seem that no harm has been done to picture-visibility. Actually, however, viewing-comfort may be diminished by auditorium lighting which is bright, yet not bright enough to affect pictorial contrast.

Dark Theatres Popular

It can do this by increasing the visibility of the interior of the auditorium, thus presenting to the eye quite a number of visual distractions. The patron also becomes aware of the fact that he is himself clearly visible to his neighbors, that he is being watched, and he accordingly is unable to relax. Dark theatres are more popular than lighted ones, as a rule.

These observations do not apply to the regular house-lighting turned off when the show starts.

Movie screens are supposed to have a high reflecting power to meet projection requirements. It goes without saying that the higher the reflectance of the screen, the brighter will be the picture. But if a screen reflects 80% of the light falling upon it from the projectors, it will also reflect 80% of the light coming to it from illumination in the auditorium. This suggests that a screen has the potentiality of being its own worst enemy.

While no contrast may be lost when black-and-white films are shown, the color of the deeper tones in color films may be appreciably reddened by auditorium-lighting.

Suppose that we coat our 80%-reflectivity screen with a neutral gray paint to cut the reflectivity in half. The resulting 40%-reflectivity screen will appear light gray instead of white, the picture will be only half as bright as before, and so will the reflected auditorium-light. Suppose that we now double the intensity of the projection light. The picture will then be exactly as bright as it was on the white screen, but spill light will be only half as bright. The deeper tones in pictures will be darker and less reddish.

Preview Room Screens

Gray screens are not advocated by us for theatre use, however, because it is more practical to cut auditorium lighting in half than to double the projection light. The gray screen nevertheless is useful in studio preview rooms in which it is necessary to take notes or read a script while a film is being shown. Because preview-room screens are very small, it is possible to use medium gray screens and quadruple the projection illumination for normal picture-brightness.

The contrastiness of the images on the film varies a great deal. In most cases the prints are developed to give maximum contrast with minimum loss of the photographic detail recorded on the negatives. Some detail is lost in the positive, either in the extreme highlights or shadows, depending on printing density; but the loss is not generally regarded as important. Comparison of a number of old silent prints with modern films fails to reveal any great improvement in emulsions.

3-D Contrast Control

Contrast must be very carefully controlled in the processing of stereoscopic films in order that the corresponding images of stereo pairs match each other perfectly in density and color. Modern machine processing fortunately permits close control.

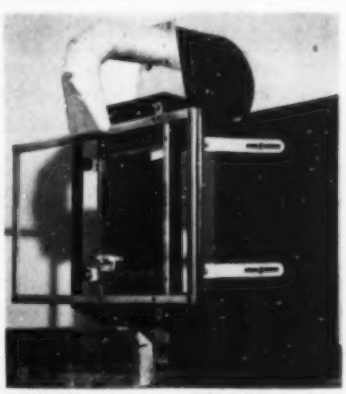
The contrast of projected pictures is lowered by the use of dirty, scratched, or uncoated projection lenses. Oil-fog condensed upon the lens-surface immediately facing the aperture is a common cause of light-scattering and lowered contrast — as well as of hazy focus. Brand-new projector mechanisms which prevent oil leakage to the film side of the machine do not entirely eliminate the fogging of the lenses by oil.

Prints are run on both old and new machines, and are bound to get messed up with oil as they pass from theatre to theatre. The heat in the aperture vaporizes some of this oil, and the comparatively cool glass surface of the lens condenses it. The projectionist

(Continued on page 27)

3-D Filter Cooling Unit

A porthole filter alignment and cooling mechanism, designed to provide a permanent air-cooled mounting for the filters needed when projecting 3-D films, is now available from the Drive-in Theatre Mfg. Co., Kansas City, Mo. This product will be found useful because the Polarizing material in filters becomes less stable with increasing temperature, and cooling is necessary if they are expected to retain their properties over a period of time.



Porthole filter alignment and cooling mechanism for 3-D filters.

The housing of the mechanism fits snugly on the inside of the projection porthole. An adjustable sliding frame allows the projectionist to quickly slide the filter to one side for standard projection. The bottom of the housing slants downward at a 25-degree angle so as not to interfere with the beam when the projection angle is steep.

Eight Adjustments Possible

The framing unit allows eight adjustments for lining the filter up at the required angle to the projection beam. It is so constructed that once proper alignment is made it can be permanently locked in place even though the projectionist is able to slide the filter to one side when a flat film is being shown.

The blower provides 100 cubic feet of air a minute. The duct and spreader are constructed of metal, making the entire unit fireproof. The spreader is designed to distribute air over the entire surface of the filter.

Projector Carbons for New Motion Picture Systems

Recent developments in the motion picture industry, such as 3-D and wide-screen projection, have resulted in a need for more projection light. The following article presents a detailed picture of the capacity of presently available arclamp equipment and examines the potential of some experimental high-powered carbons expected to be available soon for theatre use.

By F. P. HOLLOWAY, R. M. BUSHONG and W. W. LOZIER

National Carbon Company

A Division of Union Carbide and Carbon Corp.

THE attention of theatre owners and projectionists, is now focused on the need for more projection light created by recent developments in the motion picture field — wide-screen 3-D, and outdoor theatres. In some instances, projection light requirements have been greatly altered compared with conventional projection, necessitating a complete reappraisal of carbon arc light sources and lamp equipment.

A complete summary of the amount of screen illumination obtainable with the popular combinations of lamps, optical systems and carbons used for 35-mm motion picture projection was published in 1947.† The years since have seen important new developments in all aspects of motion picture projection systems. Hitex* 13.6-mm, super high-intensity carbons were introduced in 1949 for use in rotating-carbon, condenser-type lamps at 170-180 amperes.

Recent months have witnessed the introduction of a new 13.6-mm standard high-intensity carbon to replace the former one used in condenser-type lamps at 125-150 amperes. A new Suprex* 9-mm positive carbon has extended the range and output of the non-rotating carbon, reflector-type lamp used with copper-coated, non-rotating carbons. A new Suprex 7-mm positive has made possible increases in efficiency and light output compared with Suprex 7-mm carbons formerly used. New high-speed, reflector-type lamps employing rotating 9- and 10-mm positive carbons have been marketed and are finding wide usage.

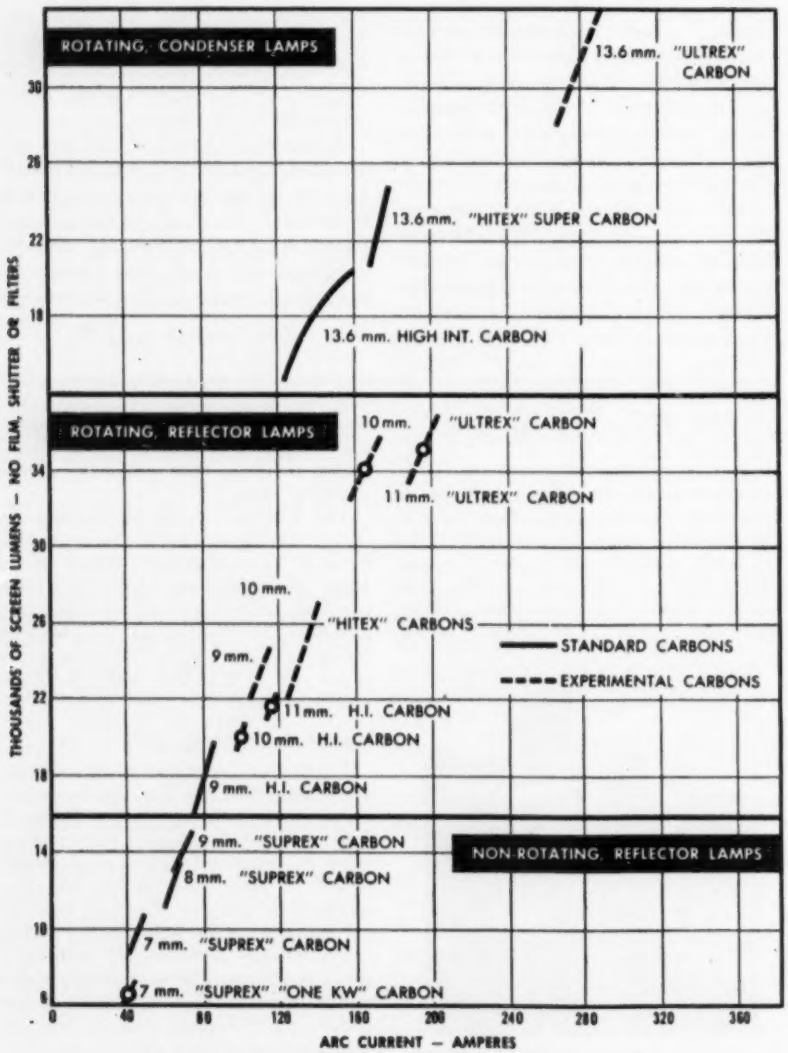


FIG. 1. Maximum Screen Light vs. Arc Current.

New Powerful Carbons

In addition to these combinations already in commercial usage, National Carbon Co. has developed several new carbons specifically to meet the demands of the new projection systems. These include the new Hitex 9- and 10-mm carbons for rotating-type reflector lamps; and the new Ultrex* 10-, 11-, and 13.6-mm carbons which are most effective when used with adequate water cooling in rotating-reflec-

† "Screen Illumination With Carbon Arc Motion Picture Projection Systems," by R. J. Zavesky, C. J. Gertiser, and W. W. Lozier; Journal of SMPE, 48: 73-81, January, 1947.

* The terms "Hitex," "Ultrex" and "Suprex" are trade-marks of Union Carbide and Carbon Corp.

NOTE: A paper to appear in a forthcoming issue of the SMPTE JOURNAL will give more technical data anent the subjects discussed in this article.

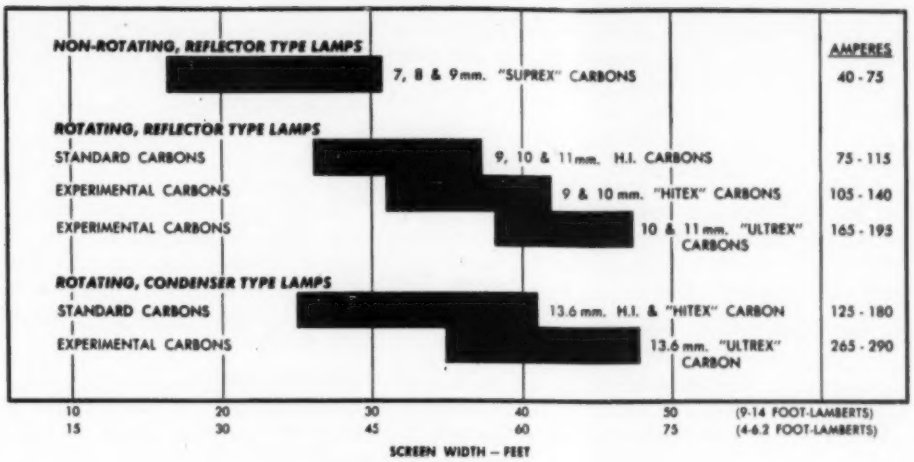


FIGURE 2

Size of Screens Capable of Illumination to Indicated Screen Brightness at Center of Screen.

[Based on maximum light, 50% shutter transmission, 90% projection port glass transmission, 75% screen reflection factor, and 4 by 3 picture aspect ratio.]

tor as well as condenser-type lamps. While these new carbons have not been placed on the market as yet, they will be available whenever suitable lamps are announced.

Figure 1 shows maximum screen lumens at different arc currents for various lamp and carbon combinations with no film, shutter or filters. Values of screen lumens obtained with the lamps and optical systems adjusted to produce 80% side-to-center distribution ratio are not shown, but they generally fall 10 to 25% below the maximum values. Fig. 1 shows that the rotating-type reflector and condenser lamps are capable of projecting more than 20,000 lumens with *standard* carbons, and more than 30,000 lumens with suitable *experimental* carbons.

Possible Protective Means

In some cases, these lamps can project more light and heat onto the film than can be accommodated without some suitable cooling means. This article does not specify means of protecting the film from high levels of radiant energy flux; it points out, however, that the use of infra-red absorbing filters, infra-red reflecting filters, controlled air-blast and the use of a water-cooled film gate have all been asserted to provide some protection to the film. Such protective means may require the sacrifice of a small portion of the screen light and will correspondingly change the lumen values of Fig. 1.

The light requirements of the new projection systems may be analyzed in correlation with these latest developments, beginning with a restatement of the American Standards Association indoor theatre standards, which recommends a screen brightness of 9 to 14 foot-lamberts with the projector running and no film in the gate.

Screen Widths, Light

The data of Fig. 1 have been used to calculate the widths of screens which can be illuminated to the aforementioned ASA standards, with a projection shutter of 50% transmission, a projection room port glass of 90% transmission, and a projection screen of 75% reflection factor.

The resultant screen widths are shown in Fig. 2. The lower ends of the screen width ranges shown in Fig. 2 belong to the smaller and lower power carbon trims and to the *maximum* recommended screen brightness; while the larger screen widths pertain to the larger and higher power combinations and to the *minimum* recommended screen brightness.

No allowance has been made for light losses that may occur with heat filters which may be needed under some conditions to prevent heat-on-film troubles. The data of Fig. 2 will need to be correspondingly altered in case there are any additional light losses beyond those assumed. For example, a 10% loss in light will reduce the indicated screen widths about 5%.

Outdoor Theatres Pose Problem

Reference to Fig. 2 shows that Suprex carbon trims are capable of illuminating screens approximately 16 to 30 feet wide at maximum light. Rotating-type reflector lamps increase these screen widths to 23 to 33, and 26 to 37, feet with standard carbons. Generally speaking, the rotating-type condenser lamps are capable of illuminating about the same width screens as the rotating-type reflector lamps.

The foregoing discussion shows the present difficulty of lighting screens of 50 to 70 feet width, common in outdoor theatres, to the standard of 9 to 14 foot-lamberts applicable to indoor theatres. However, the screen brightness requirements of outdoor theatres are not as precisely known as are those for indoor theatres, because of the widely variable physical conditions. Just what level of screen illumination can be obtained on these large screens depends upon the maximum amount of light obtained from the projection system.

Increasing the indicated screen widths by 50%, *without changing the present standard ratio of height to width*, corresponds to a screen area 2.25 times greater. Such a screen can be illuminated by the combinations of Fig. 1 to a center brightness of 4 to 6.2 foot-lamberts. These screen brightness limits have been chosen *not* because of their ultimate desirability but rather because they are in the range being obtained by some outdoor theatres. The rotating-type reflector lamps and the rotating-type condenser lamps can illuminate screens of 45 to 70 feet width to a screen brightness of 4 to 6 foot-lamberts.

Wide-Picture Requirements

Although the data contained in the tables are limited to projection from a *standard* 35-mm motion picture film aperture of 0.600 inches x 0.825 inches and thus are not directly applicable to other film aperture sizes and picture aspect ratios, rough estimates can be made in some instances. For example, the outputs of the various 35-mm film projection systems

may be redistributed by optical means over various sizes and shapes of film apertures and projection screens. If this be accomplished with minor or known losses, the results expected can be closely approximated.

The requirements of CinemaScope, which employs a standard projection frame but a 2.66 to 1 picture aspect ratio, can be calculated once the information on the transmission and reflection of the added accessories employed is known.

Except for the optical losses in the added anamorphoscope lens which functions to produce a two-fold expansion of picture *width* during projection, this expansion would produce a two-fold increase in picture area and reduce by one-half the available screen brightness *obtainable with a normal unexpanded image*. Therefore, the light requirements for the same screen brightness would be double those of *conventional* 35-mm pictures on the same type screen — that is, if the announced CinemaScope aspect ratio of 2.66 to 1 be observed.

Screen Reflectivity Level

If suitable directional-type screens of higher reflection factor, with adequate uniformity over the audience area, can be obtained, the lumen output required to illuminate a given size screen to a specified brightness can be reduced proportionately. In the case of CinemaScope projection, if a directional screen can be obtained with *twice* the reflection factor of a normal matte screen, the two-fold increase in screen area produced by the anamorphoscope lens would be approximately compensated for and the existing screen brightness with the same projection lamp would be essentially the same.

Requirements of 3-D

The stereoscopic motion pictures of the type being shown in this country employ separate lamps, projectors and 35-mm films for the projection of right- and left-eye pictures each polarized at right angles to the other; a metallic-type screen is used and polarizing viewers are worn by the audience. The light losses will depend upon the transmission factors of these various stereoscopic components, which vary with the particular design and with technical characteristics.

Typical transmission values must be discussed here, realizing that these may be altered by future design changes during the evolution of stereoscopic motion picture projection.

Present-day polarizing materials are reported to have a typical light transmission value of 40%. The viewing spectacles, likewise, are reported to have a transmission of 80%. At the present time the screen reflection factor of suitable metallic-type screens is more uncertain and subject to variation depending upon the particular type employed. A general characteristic of the metallic-type screen is an inverse relation between maximum screen reflection factor and uniformity of screen brightness over all angles of view in the theatre.

Directional Screens

Consequently, a compromise is chosen between high screen reflection factor with undesirable directional variation on the one hand, and lower screen reflection factor with better directional characteristics on the other. A reflection factor of 125% is typical for a number of screens, meaning that the *reflected* screen brightness measured in foot-lamberts is 125% times the light intensity in foot-candles *incident* on the screen.

The combination of this screen reflection factor with the transmission values of the polarizer and the viewer results in an overall light transmission of 40% (1.25 x .40 x .80 = 0.40) compared with the 75% reflection

TABLE 1. 3-D MOVIE PROJECTION BASED ON ONE-HOUR MINIMUM CONTINUOUS OPERATION

NOTE: **Values in parentheses are approximate.**

POSITIVE CARBON	Typical Positive Carbon Travel* Inches/Hour	Amperes	Positive Consumption Inches/Hour	Maximum Light	
				Screen Lumens†	Per Cent Distribution
Non-Rotating, Reflector-Type Lamps: D. C. Trim					
7-mm Suprex	7¼	40	5.8	6,500	65
Non-Rotating, Reflector-Type Lamps: Suprex Trims					
7-mm New Suprex	10	47	10	10,500	60
8-mm Suprex	10	62	10	11,800	65
9-mm Suprex	10	65	(10)	13,000	70
Rotating, Reflector-Type Lamps: Standard Carbons					
9-mm H-I	16	78	16	16,800	60
10-mm H-I	16	(95)	(16)	(18,500)	60
11-mm H-I	16	115	15	21,500	65
Rotating, Reflector-Type Lamps: Experimental Carbons					
10-mm Hitex	16	(120)	(16)	(20,500)	65
Rotating, Condenser-Type Lamps: Standard Carbons					
13.6-mm New H-I	18	160	17.5	20,500	60
13.6-mm Hitex Super	18	175	18	22,500	60

* Depends upon Lamp Design. †Screen lumens without shutter, film, filters, or stereoscopic accessories.

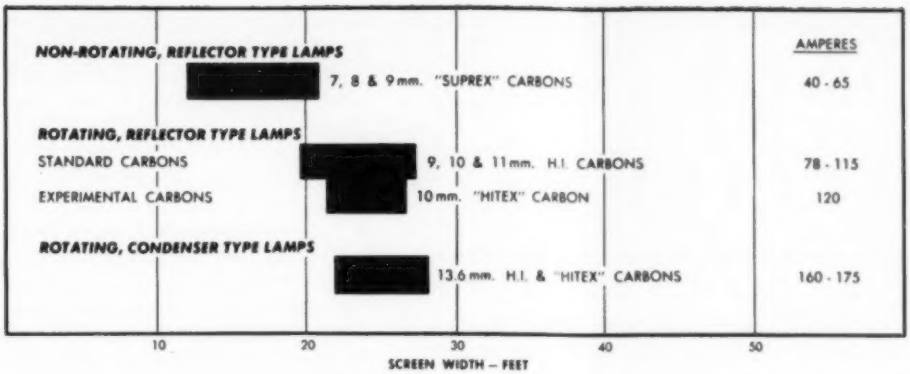


FIGURE 3

Size of Stereoscopic Screens Capable of Illumination to 9-14 Foot-Lamberts Brightness at Center of Screen—Based on Operating Conditions Producing 1 Hour Minimum Continuous Operation.

[Based on maximum light, 50% shutter transmission, 90% projection port glass. 40% polarizer and 80% viewer transmissions, typical positive carbon travel, 4 by 3 picture aspect ratio, and 125% screen reflection factor.]

factor assumed for the matte screen used for conventional projection.

The stereoscopic projection components therefore reduce the final screen brightness to a value equal to 53% (40 divided by 75 = 0.53) of that with the same projection system with a matte screen without stereoscopic accessories. In other words, the screen brightness requirement is approximately double that for conventional 35-mm projection.

The fact that separate projectors are employed for the right- and left-eye pictures does not alter the basic facts of this analysis, for each projector is subjected to this approximately 50% loss in brightness and contributes only to the brightness and picture observed by *one* eye, and the composite picture brightness visible to *both* eyes is still equal to that furnished by the individual projectors to *each* of the observer's eyes.

Should efforts to produce screens with higher reflection factor and with adequate uniformity of brightness over the theatre viewing angles be successful, then the final screen brightness figure will be increased with a corresponding decrease in the required amount of projection light.

Calculating Overall Light

On the basis of a 50% loss in picture brightness, the output of light on various size screens can be estimated by a simple proportioning of the screen widths or screen brightnesses shown in Fig. 2. Accordingly, the indicated widths of screens could be illuminated to one-half the brightness values shown and, alternatively, the various systems would illuminate screens about 70% of the widths shown to the same brightness levels employed in Fig. 2.

Still another way of looking at the situation shows that two projection lamps with *twice* the lumen output shown in Fig. 1 will be needed to produce equivalent brightness on the same size screen as in Fig. 2, but with stereoscopic projection.

Current practice with stereoscopic motion pictures using two interlocked projectors makes it desirable to consider operating conditions which will permit one hour minimum operation of the projection lamps without interruption in order to minimize intermissions for rethreading projectors. Usually this is determined by matching the burning rate of the positive carbon to the available length of positive carbon travel permitted by the lamp design and is subject to future change with lamp modifications now being considered.

The arc current, consumption rates and lumen output for one hour minimum operating time are given in Table 1. It should be remembered that these screen light values are the full output of the projection system undiminishd by shutter, film, filters or any stereoscopic accessories. A combination of these lumen outputs with the transmission and reflection factors already described for stereoscopic projection, results in the screen widths which can be illuminated to the recommended 9 to 14 foot-lamberts screen brightness range. These screen widths have been plotted on Fig. 3 for the various lamps and carbons which permit one hour continuous operation.

Removal of the limitation of one hour's operation would permit the use of all carbons at their maximum operating current, where in each case they would produce at least 20 minutes continuous burning and would project a standard 1800-foot reel. This would increase the light from some of the more powerful trims sufficiently to permit an increase in screen width of approximately 5 feet, and would make available recommended levels of brightness for screens fully 30 feet in width. The development of a suitable magazine-type lamp, designed for joining of carbons and continuous burning from one carbon to another, may be possible, thus permitting maximum currents and adequately long burning periods.

Suggested Practice

The foregoing discussion emphasizes the need for more projection light. The revolutionary techniques are still new, and since it is not practical to develop and control everything all at once, immediate perfection cannot be expected. The new carbons which have been developed will produce considerably more screen light; their successful utilization, however, will require suitable lamps and other projection equipment.

For the present, however, acceptable levels of screen brightness for these new systems are within reach, provided the equipment necessary to operate the higher capacity carbons is installed; and provided the entire projection system, including lenses, mirrors, condensers, and port glasses, is in exact adjustment and in good clean optical condition.

VA Service Work to Altec

Altec Service Corp. has entered into a contract with the Veterans Administration covering the maintainence of motion picture and radio equipment in VA hospitals throughout the country.

IN THE

SPOTLIGHT

EXHIBITORS throughout the country are watching with keen interest the outcome of the suit brought by Fanchon & Marco against St. Louis Local 143 in an effort to determine whether or not the Local can force the theatre circuit to employ three projectionists, instead of the usual two, where pictures with stereophonic sound are shown. It is the contention of many IA Locals that the successful showings of 3-D and wide-screen pictures using stereo sound depend solely upon the skill of the projectionist and that additional manpower in the projection room is necessary in order to put on a top-notch show.

In a widely-publicized address before a gathering of the Independent Theatre Owners of Ohio several months ago, Herbert Barnett, president of the SMPTE and vice-president of Cinerama, Inc., emphasized the importance of *fine* projection in the successful showings of the new processes. *(See IP for April, 1953, p. 22.)* Skill in any profession comes with experience plus expert application of one's ability in a particular field. It is a strange paradox that while the average exhibitor will splurge thousands of dollars on front-of-the-house improvements, he will balk and shy away from all thoughs of bettering the lot of the key men in his theatre — the projectionists.

• Frank J. McGuire, business representative for the newly organized IA Local on Cape Breton, Nova Scotia, known as No. 848, Glace Bay, is chairman of the committee now in process of negotiating contracts with the theatres in the Local's jurisdiction. Four contracts calling for substantial wage increases for the members have already been concluded, and additional contracts are now being negotiated.

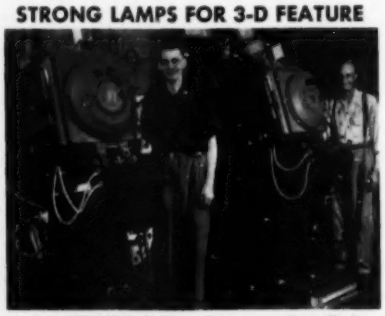
The Local, which was granted certification by the Nova Scotia Labour Relations Board, has 14 theatres and 2 drive-ins in its jurisdiction, covering the towns of New Waterford, Port Hawkesbury, Sydney and other neighboring communities.

• The AFL Union Label and Service Trades Department predicts that this year's Union Label Week, September 7-13, will set new records for labor and general public participation. High state and city officials throughout the country, in keeping with their close interest in union affairs and in the importance of the union label to the people of their communities, are expected to issue special proclamations calling attention to the event.

• Genaro G. Garcia, member of San Antonio Local 407, was recently installed as secretary of the Nat M. Washer Lodge, No. 1270, AF & AM. He is very active in Masonic circles, holding a 32nd degree in AASR San Antonio, Texas Consistory, is a member of the AAONMS Alzafar Temple, and is an active member during reunions of the Scottish Rite. Garcia, who is 51, has served Local 407 in several official capacities, the last was that of president for the years 1950 and 1951.

• IA West Coast studio Locals and the major producers are scheduled to meet shortly after Labor Day to negotiate on a new basic agreement. Among the proposals to be submitted by the Locals participating in the discussions are wage increases and a formula for financing a pension fund. Roy M. Brewer, IA West Coast representative, will be in charge of negotiations.

STRONG LAMPS FOR 3-D FEATURE



Strong 90,000-8 (3-D) Lamps were installed at the Rivoli Theatre, Toledo, Ohio in preparation for the showing of the 3-D film, "Fort Ti." Shown above are the projectionists at the theatre, Bill Lautz (left) and Belmont Holmes, members of IA Local 228.

• That honesty pays off can be proven by Marcel Fasano, member of Local 273, New Haven, Conn., who received a reward of $100 for returning a handbag containing a considerable amount of jewelry that he found at the Yale Golf Course.

• According to a recent issue of the AFL *News-Reporter*, 76% of the workers voting in representation elections conducted by the NLRB during the first quarter of 1953 voted to be represented by labor unions in dealing with their employers.

• Fresno, Calif. Local 599 set an example of good labor-management relations when a gold life membership card in the Local was presented last month to Gerald Hardy, president of the Westland circuit. The presentation took place at a banquet given in Hardy's honor in celebration of the signing of the circuit's 19th annual contract with the Local. The new pact provides for wage boosts of from 15 to 20 cents per hour for the Local membership.

• *Recent out-of-town visitor to IP:* Clyde Cooley, secretary of Omaha, Nebr., dropped in for a chat and aired his views on the new 3-D and wide-screen processes. Cooley favors wide-screen pictures and is very enthusiastic about its acceptance in the industry.

• The sponsors of the recent testimonial dinner-dance given in honor of Mike Berkowitz, Harry Mackler, and Joe Abrams, Local 306 old-timers, donated the balance of the proceeds, after all expenses were covered, to the Harry Sherman Memorial Heart Fund of the 25-30 Club. The contribution represented a substantial sum, and we understand that the many friends throughout the country of the late Harry Sherman have been contributing regularly to the fund founded in his memory.

• The membership of Los Angeles Local 150 approved a 5-year contract with the Gilmore and Victory Drive-

In Theatres at a special midnight meeting held June 25 last, thus ending a 6-months' strike against these theatres. Among other benefits the contract provides for a 12c per hour increase retroactive to October 1, 1951, an additional 15c per hour retroactive increase to October 1, 1952, and another 12c per hour increase from October 1, 1954 to September 30, 1956. The signing up of these two theatres leaves but one non-union drive-in holdout — the Roadium Drive-In. Union officials are making every effort to settle all differences with the Roadium management and they are confident that they will be successful in this direction very soon.

• William H. Hartnett, Sr., business representative for Ottawa Local 257, and George H. Jones, secretary for Toronto Local 173, were initiated last month into the Canadian Famous Players' 25-Year Club. The initiation took place at the beautiful St. Andrews' Golf Club in Toronto, where the newly inducted members were presented with engraved scrolls and with diamond-studded pins. In addition, they were given the choice of either a $100 bond or a gold watch. Each year members of the 25-Year Club are eligible for 4-week vacations with pay for the duration of their employment with the company.

George Jones, of the Toronto Local, voiced the opinion of those present at the ceremonies when he stated "We in Canada are proud to be associated with such a great company."

Mrs. Hartnett and Bill Hartnett, Jr., who is assistant manager of the Regent Theatre in Ottawa, were guests at the affair.

• It was only upon the insistence of George B. Barrett, business representative for Local 170, Kansas City, Mo., that the management of the Orpheum Theatre in Kansas City, placed an extra man in the projection room during the showing of the 3-D film, "It Came From Outer Space." This is another instance of an aggressive union official sticking to his guns and fighting for what he thinks is due his members.

• New two-year contracts retroactive to February 1, 1953 between Winnipeg Local 299 and 34 exhibitors, were approved by an arbitration board consisting of 3 members — Samuel Herbst, Local 299 nominee; S. R. Miles, exhibitor nominee and H. G. H. Smith, chairman of the board. The contracts provide for pay increases from 15 to 50 cents per hour for the first year, and for an additional 10c per hour for the second year. They also provide for extra pay for holidays, Saturdays and for relief work after 11:30 p.m. Ed L. Turner, business representative, represented Local 299 in the hearings before the arbitration board.

• Nathan D. Golden, director of the Motion Picture and Photographic Products Division of the U. S. Department of Commerce, has been chosen to represent this government at the forthcoming XIVth International Exhibition of Cinematographic Art (Venice Film Festival) in August. He will sail on the liner, the *Independence*, which leaves New York on July 23 for Naples. Golden is well-known in the industry and holds a life membership card in Cleveland Local 160.

In National Carbon Post

The National Carbon Co. has announced the appointment of J. R. Johnstone as manager of its carbon sales department. Mr. Johnstone was engaged in various sales and administrative functions before receiving his present assignment with the National Carbon Co. division of Union Carbide and Carbon Corp.

J. R. Johnstone, recently appointed manager, carbon sales department, National Carbon Co.

Lighting carbons for the motion picture industry will be high among Mr. Johnstone's interest because of the increased light demands of the new techniques. Also included in his new activities will be the sale of carbon and graphite brushes for motors and generators, and carbon and graphite chemical and mechanical specialty products.

Pension Protection — Goal of Labor

Foremost in the minds of Labor men these days is adequate pension protection, a topic which has generated intense interest in IA ranks for many years past. Herewith is the first of a series of articles which reflects the official view of the AFL.

PERHAPS the most conspicuous development in recent collective bargaining history has been the rapid spread of negotiated retirement plans. As of mid-1950, about 5,000,000 organized workers were covered by contractual pension plans — a threefold increase since 1948. The number has continued to grow since then.

On the surface, this seems to represent a very substantial amount of progress toward overcoming the economic hazards of old age. Unfortunately, the figures are misleading. The *restrictions* and *limitations* of most of these plans are such that, out of the more than 5,000,000 workers described as being "covered," very few have any *real* assurance of ever actually receiving a pension.

Social Security Not Enough

The figures are, nevertheless, an indication of the manner in which unions are trying to meet the very real and human problems faced by their older members. Few union men can see their fellow-workers tossed out of the shop on their Social Security — with poverty and dependence awaiting them as the end-reward of a long, productive and dues-paying work life — without feeling that something should be done about it.

The Social Security system, even after recent improvements, still remains pitifully inadequate. A private pension plan will, therefore, seem to many to provide a sound and logical solution to the financial problems of the aged. Older members will naturally favor the idea. Younger members who can see far enough ahead to consider the time when they will be in the same boat, will also be inclined to approve.

The subject of pension plans is not a simple one. The union official must rely to a large extent upon the "experts" who do that sort of work for a living. Up to a point, he will have to take their findings at face value.

The paternalistic type of employer usually regards a pension as a gift or gratuity granted as an act of benevolence, or mortal duty, to his "old and

(Continued on page 26)

Water-Cooling for Projection Carbons

What Are the Facts?

By CHARLES A. HAHN

J. E. McAuley Mfg. Co., Chicago, Ill.

FREQUENTLY we open our favorite trade journal (IP) and are confronted with advertisements proclaiming the miraculous advantages to be derived through the use of "screw-on" water carbon-cooling devices, the use of which will result in (1) more light (how?); (2) cool operation (where?); (3) slower carbon consumption (why?); and, strangely enough, that such units are essential for 3-D projection (why?).

Nowhere in the reputable scientific literature is there any authentic data which would substantiate such claims. We're now talking about the use of water-cooled positive carbon contacts in combination with the type and kind of carbons (coppered or uncoated) at present available and used universally for projection arclamp service.

Let's Look at the Record

To the contrary, there does exist undisputable scientific data which proves that the use of contact water-cooling, in combination with *standard* projection carbons, actually produces results which refute the claims advanced by those who exploit such devices. Results, easily measurable by any serious worker in the field, have been spread upon the record in fulsome measure.

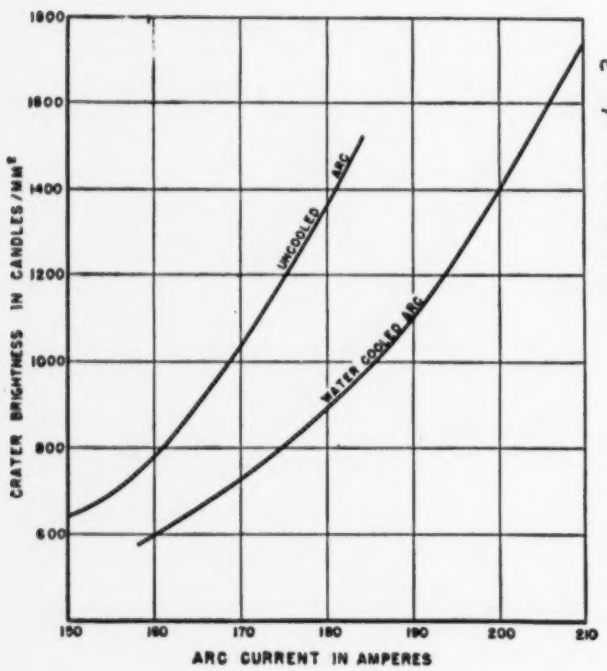
For example, in the *SMPE Journal* for April, 1949 (pages 395 through 416) there appear two articles on this very topic — one authored by Messrs. Jones and Bowditch, of National Carbon Co., and the other by Wolfgang Finkelnburg, of the Research and Development Labs., Fort Belvoir, Va. (These articles appeared in IP in the June and July, 1949, issues.)

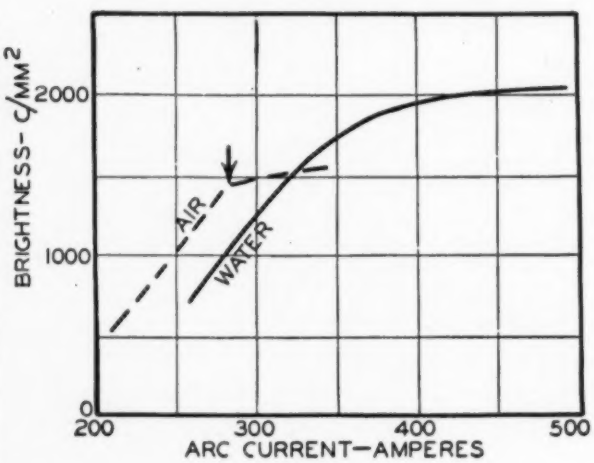
The conclusion of the Jones and Bowditch study was that, when burning our present day *standard* projection carbons or the *special experimental* high-brightness type of carbon, the introduction of water-cooling always *reduced* the total volume of light when identical amperages were used at the arc. Hence, at the current rating of standard air-cooled carbon trims, the use of water-cooling with even the high-brightness type carbons resulted in reducing their crater brilliance.

Arc Efficiency Reduced

It was definitely indicated by Finkelnburg that the uncooled arc is by far the most efficient at 180 amperes (the top amperage for 13-mm *present-day* projection carbons). When water-cooling was used, it became necessary to raise the arc amperage to 200 in order to reach the *same* level of crater brilliance as was produced by the uncooled arc burning at 180 amperes. It was shown, with immaterial exceptions, that the uncooled, normal arc, when operated within or at the current limits now generally used for projection purposes throughout the country, produces superior results than when water-cooling was employed.

Both articles indicate further that, when any real gain was made through the use of water-cooling, it was only under certain specific operational conditions requiring that up to 290 amperes be used at the arc — and then





LEFT: Comparison of crater brightness of cooled and uncooled arcs at equal currents.

RIGHT: Comparison of air- and water-cooled operation for new higher-current 13.6-mm "high-brightness" carbon.

only in conjunction with specially-made experimental carbons of the high-brightness type. High-brightness carbons have a very high consumption rate, about 40 inches per hour at 280 amperes, are extremely expensive and are *not* in regular production.

Realistic Outlook Needed

Compare this with the amperage level now generally used for projection up to 180 amperes with the 13.6-mm positive carbon. Let's get realistic.

Consider the type of arclamps that would be required to withstand the heat of such high amperages. What means are to be employed to eliminate heat-on-film damage? What about the extensive and expensive changes required in electrical house wiring? And what about the unavoidable necessity for larger-capacity generators?

All these changes would be necessary to accommodate a carbon that is consumed at approximately *twice* the present burning rate and at least *twice* the present cost. Can this make water-carbon-cooling essential to 3-D when, with the slower burning carbon, we are now sacrificing screen illumination just to make the carbons suffice for a 5,000-foot reel of film?

Take particular notice of the fact that the lamps used by Jones and Bowditch, and by Finkelnburg, were especially designed and made with the water-cooling arrangement built-in. Also, there was provision to cool the negative as well as the positive carbon. No "screw-on," single-carbon, water-cooling arrangement was used.

The burning of projection carbon trims has much in common with the burning of coal for heat: the more you burn over a given period of time, the more heat-light you will get from it. In the case of carbon arcs, the main product we seek through their consumption is *light*, and its quantity or volume is determined by the amount of carbon that is consumed.

Increasing Total Light

So you can see why an increase in total light requires larger diameter carbon combinations. These are then burned at higher amperages, further increasing the total amount of carbon consumed. All things being equal, we doubt if anybody can reduce the consumption rate of a fuel and still come up with a gain in the output of the product you burn it for. It's as simple as that.

I would be agreeable, if any manufacturer of contact water-cooling devices would also agree, to submit lamps for testing at identical amperages and equipped with and without "screw-on" contact coolers to an established and impartial testing laboratory, such as the Armour Institute in Chicago, with the understanding that we would publicize the results of the "with" and "without" tests, and also name the product. I would gladly pay the testing cost if use of the water-cooling device actually does produce more light, cooler operation, or result in slower carbon consumption. If it doesn't do the job, *they* pay the bill.

Underwriters' Laboratory

Also important is the attitude of the Underwriters' Laboratory. When such devices are installed on projection arclamps already approved for operation *without them*, the blanket approval of the lamp automatically become null and void. This is also true when carbon-saving devices are installed, when metal is used in place of glass reflectors, or, for that matter, if any kind of alteration is made in the construction of the lamp from its original form.

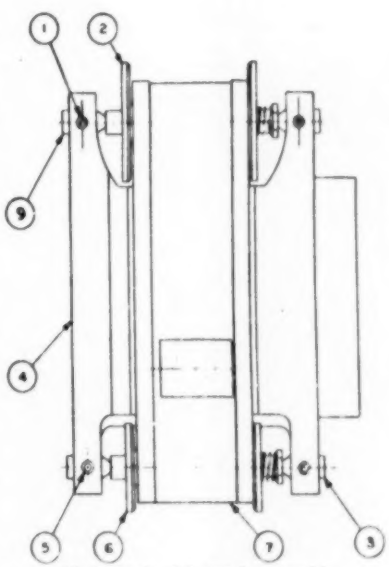
At this date, I know of no complete projection arclamp employing contact water-cooling nor any "screw-on" contact water-cooling device that is now or ever was listed by the Underwriters' Laboratory for unrestricted use.

LETTERS TO THE EDITOR

To the Editor of IP:

Recently a projectionist wrote in and asked us why Motiograph, Inc., like other projector manufacturers, did not provide our AA projectors with studio guides.

You are probably familiar with the fact that our prewar Motiograph, the Model K, employed studio guides. We found that those studio guides were very fine when projectionists were running brand-new prints, but when film shrinkage took place, they actually ceased to have any value in controlling sideway of the film. The sideway, of course, brought about a rapid sideways jiggle of the picture on the screen. The amount of weaving actually increased as the studio guides became grooved.



Motiograph AA track assembly

In the AA, the lateral guiding of the film over the tracks is accomplished by the two guide roller assemblies, Items 2 and 6 in the accompanying illustration. Each has a fixed flange, or roller half, for the soundtrack side of film, and a moveable flange under the small spring tension for the opposite side, to accommodate films having various degrees of shrinkage without producing film buckling or failure of the guiding action.

Sideway Effectively Controlled

The roller assemblies are relatively close to the aperture opening and are, we believe, much more effective in eliminating film sideway than non-rotating fixed types of lateral guides. The rollers are large in diameter so as to derive sufficient turning torque from the moving film, and are fabricated from very tough and thoroughly hardened steel alloy to resist wear. They turn freely on hardened pivot-type bearings lubricated internally through small openings in the tips from grease reservoirs within the bodies of the bearings.

More than 2000 theatres have proven, we think, that our method of lateral guiding of the film is quite superior to the method of guiding the film by means of studio tracks. The only times when our method has not worked perfectly was where periodic cleaning and lubrication of the bearings of the guide roller assemblies were not given.

This communication is a verbatim

(Continued on page 26)

Outline of 16-mm Projection

Presenting some comments on the history and operation of 16-mm projectors, abstracted from a very complete text-book on the subject.*

IV

ASIDE from provisions of excluding light from the room until the general level of illumination is of the order indicated, it is particularly necessary to make sure that no narrow beams of light (such as sunlight) enter the room to produce bright spots on the walls near the screen or strike other objects in the room from which noticeable reflections may be obtained.

For audience comfort, the screen should be by far the brightest object in the room. It is also preferable for the screen to be placed at least several feet away from a nearby wall so that the light "sprayed about" by the screen does not reveal nearby wall detail.

The Non-Theatrical Equipment Committee of the Society of Motion Picture and Television Engineers published a report in the Journal of the Society in July 1941 that provides specific and authentic recommendations relating to the use of 16-mm projectors in classrooms. Much of the data presented is applicable to any kind of 16-mm projection and may be used as a guide to equipment selection and use. One very important point discussed is the location of the audience relative to the screen; for convenience, audience location is described in terms of screen widths. In the case of a machine with a 750-w. lamp, the proper screen width is 5 ft. for 10 ft.-lamberts screen brightness.

SMPTE Recommendations

(1) The nearest row of seats shall be no closer than 2 screen-widths from the screen; a preferred minimum distance is 2.5 screen-widths. In terms of the 5-ft. screen, the first row of seats should be not less than 10 ft. away, with 12.5 ft. as the preferred minimum.)

(2) The farthest row seats shall be no farther than 6 screen-widths from the screen; a preferred maximum distance is 5.5 screen-widths. In terms of the 5-ft. screen, the last row of seats should be not more than 30 ft. away, with 27.5 ft. as the preferred maximum.)

(3) No seat shall be farther away from the line between the projector and the screen than its distance from the screen. This is equivalent to an angle of 30° on either side of the projection axis.

Although it is definitely undesirable to do so, many screens are operating considerably below the 10 ft.-lambert brightness level. In a number of cases the screen chosen is entirely too large for the projector. In the other cases, improvement can be made by making certain that the terminal voltage of the lamp is in strict accordance with the lamp voltage rating. Projection lamps can be obtained in rated voltages from 105 to 130 in 5. v. steps; it is very desirable that the correct lamp be used in all projection, especially in the projection of color film. Should the screen brightness level drop below 6 ft.-lamberts, the cause should be determined and the condition corrected.

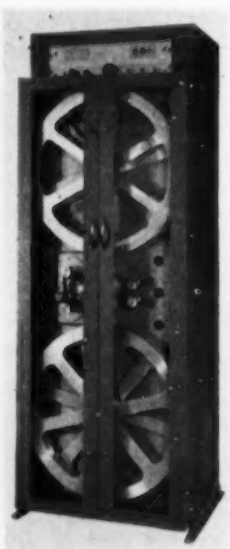
The recommended value of 10 ft.-lamberts should not be considered inflexible. Some films may warrant a somewhat higher value because they are dense, while others may warrant a somewhat lower value because they are light. Many prints are made light intentionally to attempt to compensate in some degree for possible poor screen brightness of the projector;

* Cond. from "16-mm. Sound Motion Pictures," by W. H. Offenhauster, Jr., published by Interscience Publishers, Inc., New York.

Multiple Magnetic Tracks with Picture Opposed

Although multiple sound tracks on a single strip of film along with the picture *may* prove practical, there are many technical disadvantages, and the major studios may decide against using this system, it was asserted recently by D. J. White, president of the Magnasync Mfg. Co., North Hollywood.

"Our experience as one of the largest manufacturers of magnetic film recording and reproducing devices makes us wary of magnetic sound tracks outside of and too close to the sprocket holes," he said. As the first group to present a perfected 16-mm magnetic film recorder before the SMPTE (May 1948), Magnasync engineers are well qualified to judge the relative merits of most magnetic film devices, White pointed out.



Magnasync magnetic reproducer No. 335-T, as viewed from front

"Exhibitors should be made aware," he added, "that the *film transport* portion of their projectors would be rendered obsolete if the proposed combination film and multiple sound track system were to win acceptance. Magnetic sound tracks will deteriorate rapidly if caused to pass over the hardened steel components of standard projectors. Much research is ahead of us before we develop projector transports with nonferrous (non-magnetic) materials which will stand up under the beating taken by projector movements.

Film Transport Unadaptable

"The present separate reproducer standard may well continue regardless of progress in magnetic-projector soundheads. Theatres will be equipped, projectionists become familiar with the technique, and in general a great deal of momentum developed in favor of the separate magnetic sound system."

The Magnasync company produces the "Magnaphonic Theatre System" which is described as a unitized package starting with a 3-channel, 35-mm reproducer priced at $2,350. Pre-amplifiers, control panels, monitor amplifiers, power amplifiers and speakers are added according to the requirements of the individual theatre. Complete Magnaphonic systems are available starting at $5,300.

The company also points out that the equipment could be adjusted at minimum expense for use with any of the proposed new systems, as yet only in the "thinking" stage, if they come into use.

such prints are inferior in pictorial quality in that much of the shadow detail is lost. If some degree of deviation is unavoidable, it is preferable that it shall be in the direction of greater rather than lesser screen brightness.

16-mm Sound Reproduction

Good sound reproduction involves two major characteristics; its volume, and its clarity and freedom from distortion. With a good film on a good machine, the volume can be controlled by the volume control; the quality or tonal balance by means of the tone control. Both are partly dependent upon the acoustical conditions of the room or projection space. The volume of sound needed for most comfortable and satisfactory reproduction depends upon several factors other than room size. One of the most important is the reverberation characteristics of the room, which are dependent to a considerable degree upon the amount and the kind of sound-absorbing material present.

A room in which the walls, ceiling, and floor are all of hard materials (cement, plaster, or wood) requires relatively little sound energy from the loudspeaker to produce a loud effect. A particular sound being reflected and re-reflected numerous times loses some of its energy with each reflection and finally becomes inaudible. A prior sound has not ceased before a subsequent sound appears; sound heard under these conditions does not have the pleasing clearness that occurs in the well-furnished living room of a home where there are curtains, rugs, overstuffed furniture, and cushioning materials that absorb sound to a considerable degree. Such sound may be described as "blurred."

A reasonable starting point for sound projection is a room in which it is easy for two persons — one at either end — to converse in an ordinary tone of voice without difficulty when they are not looking directly at one another. (This avoids lip reading.)

[TO BE CONTINUED]

16-mm Lending Service—N. Y. Library

A library of 16-mm documentary films is now available at the New York Public Library. Under this new lending service, made possible by a grant from the Ford Foundation for Adult Education, films explaining American history and ideals will be offered for loan to non-profit community groups.

Super Snaplites are better indoors or out. Sharper Pictures, Greater Contrast, More Light, Better Definition all add up to happy patrons. Make your Movies Better Than Ever; use Super Snaplite lenses. Super Snaplite Projection Lenses give a true speed for f/1.9 in every focal length up to 7 inches. Ask for Bulletins 207 and 209.

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Nord Single-Film 3-D Process

The Nord system of projecting 3-D from a single film strip was demonstrated recently in New York and Hollywood. Requiring only a single 35-mm projector equipped with a special attachment in front and a corrective lens, the system is said to make possible a considerable reduction in the cost of producing and exhibiting 3-D films.

The system places two stereo images side by side on one 35-mm film strip. In the production process the images are turned an placed vertically or side ways on the film frame so as to fill the entire area of the frame.

Nord asserts that it has a number of advantages over the present double-film methods. Both images retain exact syncronization on the screen because they are locked together on the film frame and in the Nord projection converter — a device placed before the projector that splits the beam from the projection lens and simultaneously transmits the two images to the screen.

Converting Existing Films

Nord promises that any 3-D film now ready can be used in the Nord system *if* the double-film images are transfeered to a single film strip by an optical printing process. Nord states that 3-D units will be rolling off the production line within 30 days after the announcement in Hollywood that prints will be made available. Although the price of the projection equipment is not yet set, it is said to be low enough to make it available to even the smallest theatres.

As in other 3-D systems, Polariod filters and glasses, and a metallic, highly directional screen are required.

RCA's New Wide-Arc Lamp

A new RCA Wide-Arc lamp system, a type of lamp used in recent CinemaScope demonstrations, is now available for wide-screen, 3-D, and drive-in theatre use. This lamp is said to provide sufficient light to illuminate oversized screens up to 70 feet in width when operating at a maximum of 128 amperes using a Hitex 10-mm positive carbon.

Features of the Wide-Arc lamp include special cooling devices, a large 16-inch diameter reflector, and a reliable feed mechanism which rotates the positive carbon at a speed of 15 revolutions per minute compared to about 8 revolutions for the RCA Brite-Arc lamp.

To reduce heat on the film, the lamp employs heat reflecting glass with a motor-driven fan mounted between the lamp and the shutter housing. The system also uses a new RCA water circulator which operates directly from the arc voltage. When D.C. power is supplied to the lamp, the water circulator starts automatically.

New Stack Assembly

Heat generated by the Hitex carbons is removed from the lamphouse by a new stack assembly located immediately above the arc flame, an arrangement that is said to keep the reflector and the inside of the lamphouse free of combustion dust. Cool air is drawn in through a series of ventilating holes toward the bottom. Dowser control handles are located on both sides of the lamp at the screen end.

The lamp can be operated up to 98 amperes with standard 10-mm carbons without need for the heat-reflecting glass or motor fan. Two new motor generators to power the Wide-Arc lamp were also announced by RCA. They are the type 19 motor generator for use on a 208-volt line, and the Type 20 for operation on a 220-volt line. Both provide 125/250 ampere, 90-volt outputs.

New Strong Rectifiers

A new line of heavy-duty rectifiers, designed for continuous operation during 3-D and wide-screen projection, and also for drive-ins, has been announced by the Strong Electric Corp.

Three of these rectifiers are of the selenium plate type; one is of the tube type. All of the selenium rectifiers may be used with angular or coaxial trim lamps. They are rated at 105-135 amperes for 11-mm carbons or 10-mm "Hitex" carbons, 90-105 amperes for 10-mm carbons, and 75-90 amperes for 9-mm carbons. The continuous-duty, tube-type rectifier has a capacity of 75-85 amperes on 3-phase, 220-volt current.

Transformer taps provide adjustment to compensate for supply-voltage variations through a range of 10% above or 10% below the rated A.C. input voltage throughout the output-rating range. All four of the rectifiers feature automatic, fan air cooling.

IA ELECTIONS

LOCAL 509, DULUTH, MINN.

William C. Call, *pres.*; Edgar Chubbuck, *vice-pres.*; Russell Gran, *rec.-sec.*; Ernest Poling, *fin.-sec.*; Fred Daneiko, *treas.*; Hal Olson, *bus. rep.*, and Walter Quick, *sgt.-at-arms.*

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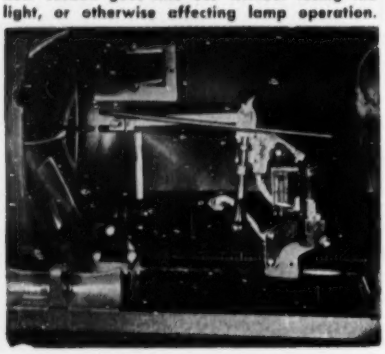

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OBITUARIES

RAY E. FERGUSON, 57, member of Projectionists' Local 509, Duluth, Minn., for the past 35 years, died June 20 of carbon monoxide poisoning while working on his car. Ferguson was active in union affairs having served as president and business representative for the Local during the past years, and was a delegate to the Federated Trades Assembly. He was a member of AAD Temple Shrine wrecking crew; Masonic Lodge; Duluth Commandery No. 18; Knights Templar and Lakeview Lodge No. 92, and of the Royal Arch Masons.

ALLEN J. TINDAL, 56, business representative for Local 253, Rochester, N. Y., died June 16 of a heart attack. Tindal became a member of Local 253 in 1931 and served as president for the years 1947 and 1948.

A native of Ogdensburg, N. Y., he came to Rochester 25 years ago, and for the past 20 years worked as projectionist at the Liberty Theatre. He was a past master and current secretary of Orpheus Lodge of the Masons; past grand steward of the Grand Order of Masons of the State of New York, and was a member of the Flower City Link, Order of the Golden Chain.

MIKE BERKOWITZ, 79, veteran member of New York Local 306 and past president of the 25-30 Club, succumbed July 16 to a lingering illness. Although his death was not unexpected, it came nevertheless as a shock to his many friends in projection circles. The career of Mike Berkowitz encompassed a span of many years and it was only his modesty that prevented him from receiving recognition in the industry for his many outstanding contributions to the art. His last public appearance was at a testimonial dinner tendered in his honor about two months ago. The death of Mike Berkowitz ended the career of one of the truly "grand old men" of show business.

Motiograph 3-D Booklet

An illustrated booklet on 3-D motion picture projection is available from Motiograph, Inc., Chicago. The booklet gives a brief history of the various new screen techniques and describes their present status. Particular attention is paid to 3-D projection. There is detailed coverage and illustration of Motiograph equipment for showing 3-D films.

Among the subjects covered are: 3-D theatre equipment, 3-D in drive-in theatres, 3-D interlocks, installation, oversize magazines, new arclamps, generators and stereophonic sound.

Altec Stereosound Clinics

The fourth in a series of stereophonic sound clinics, recently inaugurated by the Altec Service Corp., was held last month at the Saenger Theatre, New Orleans, in conjunction with the CinemaScope demonstration in that city. Altec also announced that it has installed stereosound in a large number of Pennsylvania theatres.

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Bausch & Lomb *Super Cinephor* Projection Lenses

LETTERS TO THE EDITOR

(Continued from page 21)

transcript of our reply to the inquiring projectionist, and is sent to you with the thought that our method of guiding the film in the AA projector will be of interest to many of your projectionist readers.

FRED C. MATTHEWS
Motiograph, Inc., Chicago, Illinois.

To the Editor of IP:

I would like to point out that the diagram and accompanying explanation that appears on page 12 of the June issue for IP *does not* illustrate the convergence obtained, as you say "by converging the camera lenses at a point much closer to the viewer than the objects on the same plane as the screen."

What your diagram *does* correctly illustrate is the normal configuration of left- and right-eye images in a superimposed stereogram, such as a polarized-light 3-D picture. This configuration of images results in convergence of the spectator's two eyes as he looks at the "near" objects in the projected picture. And this has nothing whatever to do with the convergence of camera lenses (or diagonal mirrors) as employed in the "Natural Vision" technique used by Warner Bros. for filming *House of Wax*.

The effectiveness of the sideshow-barker sequence in *House of Wax* was considerably *reduced* by convergence of the camera lenses. Convergence of the camera lenses magnifies and *throws back into the distance* all foreground objects. This is bad enough, but worse, the technique makes distant backgrounds almost impossible to look at by forcing the optical axes of the observer's two eyes to diverge. This is strictly and very obviously "agin nature," for even the most distant objects require the lines of sight of our two eyes to become only parallel.

ROBERT A. MITCHELL

To the Editor of IP:

I congratulate you on the struggle you are making to bring about standardization of 3-D and wide-screen equipment. The haste of manufacturers to rush new products to market is blinding them to the point where we will all suffer for the lack of a little horse sense on their part.

One local theatre ran "Wax" using the mechanical interlock, and there was a terrific vibration from the telescoping rod that was transmitted to the screen. The projectionists there were crowded for set-up time, and it is hoped that the vibration problem can be cleared up in the future. If possible would you tell me where I can get information on Selsyn interlocks, as I expect to work with them in future 3-D showings?

Again may I say more power to your pen. You can bank on the boys in the projection room to back you. We look forward to IP each month to see what you have to say.

HUGH L. PENFOLD
Sault Ste. Marie, Ont., Canada.

[Precise data anent Selsyn interlocks is available from Mr. Ken G. Parks, General Electric Co., 570 Lexington Ave., New York, 22, N. Y. — ED.]

PENSION PROTECTION

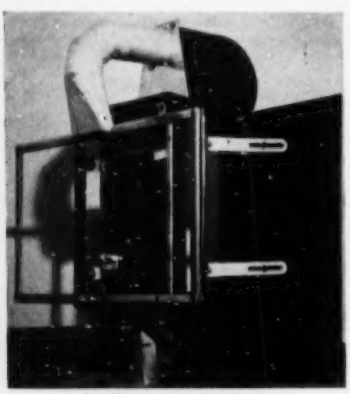
(Continued from page 19)

faithful" employees — in other words, as a bone for old dog Tray. This is a view which labor cannot accept, for it runs directly counter to the basic principles of the trade union movement.

Unions do not bargain for gifts or gratuities; they bargain for wages and *conditions* of employment. The negotiation of the labor contract is a transaction between equal parties in which equal values are exchanged — not a petition to a benefactor for charity towards a group of old retainers.

When a pension plan is brought within the scope of the agreement, both parties thereby acknowledge that it is in fact a part of the hire which the workers are to receive *in exchange for* their labor. It is not "free" and they do not get "something for nothing," as an act of grace on the part of the employer. They earn it and pay the employer for it by doing the work which constitutes *their* end of the contract.

The performance of that work is all the employer has a right to expect in return for his contributions to the pension fund. The amounts contributed by the employer to the fund, to finance the pension credits accumulated by the group during the term of the contract, should therefore be an irrevocable payment which the employer cannot withhold or



PATENT PENDING

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This mechanism has sufficient width to accept the wide angle projection of Cinerama or CinemaScope. For standard projection, all the projectionist has to do is to slide filter to non-operating side.

Bottom of housing slants downward at a 25-degree angle toward screen (for indoor theatres) so that regardless of the angle of projection, the beam will pass through freely. For Drive-In Theatres the slant is upward so that the beam will pass through freely to the screen tower.

The filter frame has eight adjustments, so that the filter may be placed in proper position for maximum light and focus — AND LOCKED. These eight adjustments are:

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recapture, just as he cannot withhold or recapture cash wage payments.

The workers' interest in the negotiated plan is equally strong regardless of whether the fund is set up formally on a so-called "contributory" or on a "non-contributory" basis. In the sense that the contributions paid in by the employer have been earned by the workers, they actually pay the full amount of the cost in either case.

Worker Should Have Voice

Likewise, the workers covered by the plan are properly entitled, through their union representatives, to a forceful voice in the control and management of the fund. This right is just as clear in the case of a negotiated plan as if it would be in the case of a fund which the workers might set up entirely through their own resources — outside the shop and without employer interference — with money which they might elect to set aside out of their cash wages.

As a matter of fact, one of the practical alternatives to the negotiation of a union-management plan, based on employer contributions, is the negotiation of an equivalent amount as an increase in current cash pay, and the use of that amount — through an increase in dues or special assessments — to set up a strictly intra-union fund.

About the only advantage to bargaining on pensions, where all the terms of the plan depend on employer agreement, lie in considerations of administrative convenience, plus the fact that employer contributions to a pension fund are not currently taxable to workers as income, as they would be if taken in the form of cash pay.

Management's Viewpoint

Pensions are a labor cost item, like all of the other economic terms of the working agreement. Viewed solely from this standpoint, it should make little real difference to the employer whether that cost is incurred in the form of contributions to a pension fund, or in the form of higher wages, paid vacations, a health insurance plan, or a reduction in standard working hours.

Under normal conditions most unions must eventually decide whether the interests of the members would be better served by going after a pension or by concentrating on the task of improving the wage scale. This is a decision which each union must make for itself, in the light of its own particular circumstances.

VISIBILITY FACTORS

(Continued from page 13)

instinctively examines that particular lens-surface whenever his pictures seem to lack "snap."

IMAGE-DEFINITION

The *definition* of the image on a movie screen depends upon a number of factors; and if a single one of them is below par the picture will suffer.

First, the cinematographer has a camera-lens to focus in order to get the sharpest possible image on the negative. Studio cameramen are very fussy about focus, and the lenses they use are the very best. Poor focus is seldom encountered in professional negatives, though there are cases of deliberate "soft focus" and instances where the cameraman is forced to compromise between foreground and background focus. The projectionist should remember that certain aged female "stars" wouldn't be in business today if it were not for the soft-focus lens and subdued lighting. The make-up man can't do everything.

Second, the graininess of negative and positive film emulsions limits their resolving power. When pictures are conspicuously grainy, the negative should be blamed. Positive emulsions are the finest-grained of all; very "fast" panchromatic negative emulsions the coarsest-grained. Extremely fast negatives are seldom used, however, except in newsreel work under very poor lighting conditions.

Fast Emulsion Graininess

Fast emulsions are made by "baking" regular, slow emulsions. That is, the suspension of silver bromide in gelatine is heated for a long period of

CinemaScope for Army Theatres

U. S. Army and Air Force Motion Picture Service is converting more than 400 of its theatres to accommodate the CinemaScope system of wide-screen projection. Theatres to be converted are located in the United States, Hawaii, and Alaska, according to Fred Bund, Jr., chief of the Army Motion Picture Service.

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time. This treatment also causes the silver bromide crystals to clump together into larger crystals, thus resulting in a coarse-grained emulsion.

Color films have less graininess than single-emulsion black-and-white films, but that does not mean that they possess superior definition. On the contrary, the best "monopack" color film has slightly less resolving power than the finest-grained black-and-white. The difference is too slight, however, to be of practical interest in projection.

Poor image-definition frequently arises in the printing process. This is sometimes due to slippage between the negative and the raw positive in contact-printing, and sometimes to poor optical adjustments in projection-printing.

Poor Definition Causes

There are eight causes of poor definition arising in the projection room: (1) a poor-quality lens incapable of good image-formation in a flat field; (2) a dirty lens; (3) projectionist inattention to focus; (4) worn film-gate runners and tension-pads which fail to hold the film flat over the aperture and square to the lens; (5) rapid in-and-out of focus flutter of the film in the gate caused by heat; (6) a worn single-bearing intermittent which causes a rapid vibration of the image; (7) poorly designed air-cooling apparatus which causes the film to flutter, and (8) defective and soiled projector-port glasses.

STEADINESS OF IMAGE

Jumpy pictures were overlooked as an inherent characteristic of motion pictures — once upon a time. Not so, today. Projection cannot be regarded as wholly satisfactory unless it is perfectly rock-steady.

Rock-steady pictures require intermittent movements of good manufacture properly adjusted and lubricated. Drive gears and intermittent sprockets should be replaced whenever wear is detected in these parts. Special attention must also be given to film-gates, tension-pads, and guide-rollers.

CAUTION! Projectionists operating on one of the most widely used makes of projector should guard against leaving the framing adjustment in one position — the midway position, for example — year in and year out. Best to change its position at least once a month in order to prevent a peculiar type of either sprocket wear or driving-gear wear which results in a trembling picture (6 small vertical jiggles per second) *whenever the picture is framed up or down to a new position.*

The cause of this strange trouble has not yet been determined exactly, although it is more common than the writer first thought. The effect is the same as that of a bent star-wheel shaft or a lopsided sprocket, but it appears only when the framing position is changed. Readers are invited to offer their opinions on this.

Rock-Steady 3-D Needed

Absolutely rock-steady projection is a prime requisite for polarized-light 3-D employing two separate films. Movements of one image relative to the other results in visual fatigue. Differences in side-weave make objects in the picture recede and approach. Cinerama has had troubles aplenty with jumpy pictures on its wide 3-image screen. The special Cinerama camera, not the Century movie projectors, has been blamed.

CUTOFF-FREQUENCY

If projection-light were cut off from the screen only during the film-pull-down periods, shutter-flicker would be terrific. A frequency of 24 cutoffs per second is much too low to be tolerated by any audience. To correct this condition, projector designers doubled the

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frequency of cutoff by adding an extra blade to the shutter. Thus we have a master blade which cuts off during the film-pulldown and a cutoff blade which cuts off in the middle of the exposure-period of each film-frame. The two blades are absolutely identical in width.

The use of the cutoff-blade wastes half of the light (the master alone wastes one quarter of the light, and the cutoff blade one quarter), but it increases cutoff-frequency to 48 cycles per second, thus reducing our perception of the rapid flicker produced by the revolving shutter.

Shutter-flicker becomes less visible when screen illumination is decreased, more visible when light is increased. When the brightness is 15 foot-lamberts, the brightness of the brightest highlights in pictures is about 8 foot-lamberts. Tests have demonstrated that shutter-flicker virtually disappears at a frequency of from 70 to 90 cyc./sec. at 8 FL. for direct vision, and from 200 to 300 cyc./sec. at 8 FL. for extreme peripheral vision.

5-to-1 Intermittents

This writer has long advocated that conventional 3-to-1 intermittent movements be junked in favor of 5-to-1 movements in order to effect quicker pulldowns of the film and longer "rest" periods. This would permit the use of 3-blade shutters having a cutoff-frequency of 72 cyc./sec. at standard film-speed of 24 frames per second. Shutter-flicker would practically vanish, and picture-illumination would not be reduced. In fact, drive-ins and other large theatres would find 5-to-1 intermittents advantageous. When used with narrow-blade 2-blade shutters (regular 48 cutoffs per second), light-transmission could be increased from the present-day 50% to fully 66.67%.

The reduction of flicker, however, is the more valuable application of the 5-to-1 intermittent movement. Such movements are practicable. Why, then, do we not have them? That's what the writer has been trying, unsuccessfully, to find out.

"KEYSTONE" DISTORTION

Unless the optical axis of a movie projector intercepts the screen squarely in the middle, the picture will be more or less distorted. When the projection room is higher than the screen, the projectors must tilt downward. This elongates the picture and, when wide-angle (short-focus) lenses are used, the picture will be wider at the bottom than at the top.

Up-tilted drive-in projectors produce an identical elongation, but result in a widening at the top of the picture.

Vertical projection angles not in excess of 15 degrees do not produce enough "keystone" distortion to impair the quality of the picture. Horizontal projection angles, however, are far more deleterious. We meet with these only in the very few theatres having projection rooms located off to one side of the center-line of the auditorium.

And yet projection from normally centered projection rooms involves slight horizontal angles. Where there are two projectors, one of them is placed a few feet to one side of the center-line, and the other an equal distance to the other side. The angles involved are too small to matter in conventional projection, but they may prove serious in wide theatres having large screens to good image-superposition in 3-D (Natural Vision) projection. The effect is to produce a blurring of the picture at both sides of the Natural Vision screen, the blur increasing with the distance from the center of the screen.

PERSPECTIVE DISTORTION

A theatre patron seated far from the center-line of the auditorium experiences a distorted view of the picture which is absent for patrons seated in the middle of the auditorium. To him the picture has become compressed — actors appear abnormally thin and tall. Curvaceous actresses look like

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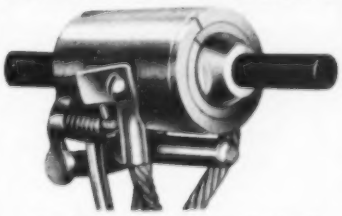

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animated broomsticks. Circles look like elongated rectangles.

This visual effect, which becomes intolerably aggravated when a screen is viewed at an angle greater than 30 degrees, is called "foreshortening." The side seats down front are at the greatest disadvantage in this respect. Patrons avoid them whenever possible.

Curved-screen projection (Cinerama and CinemaScope) combine keystone and perspective distortion to produce some mighty weird results. Straight lines are "bowed," and actors walking from one side of the screen to the other grow progressively skinnier or more plump when the picture is viewed from a side seat. A *flat* wide screen is free from some of these very objectionable faults.

3-D LIGHTING POINTERS

Time will tell if exhibitors will be willing to sacrifice about half of their seating capacity to accommodate the peculiarities of 3-D. This writer suspects that many exhibitors will retain their side and balcony seats until the public learns to avoid them during 3-D showings. Much of the merciless "panning" of "Bwana Devil" received may have been due to injudicious seating of the audience. A conscientious exhibitor will rope off the side seats out of consideration for the audience and the future of his business; but exhibitors of this character are as rare as hen's teeth.

As far as conventional projection is concerned, the actual distribution of light *on* the screen is of prime importance. It *is* also another of the many pitfalls in the path of polarized-light 3-D projected *via* two separate films. "Vignetted," or "hot-spot," projection, a necessary evil in mammoth drive-ins, has marred the perfection of theatre movies for many years.

Tv enjoys perfectly uniform picture illumination; and this is a point in Tv's favor. Movie side-to-center light-distribution of only 50 or 60% is still with us even though lamps can be purchased having a distribution (side-to-center) of as high as 80%. But even this can hardly be considered good enough in these days of rapidly improving Tv.

Good Light Distribution

There is no valid reason why the almost perfect light-distribution characteristics to which we were accustomed in the days of low-intensity arcs should not be transferred to high-intensity lamps. Optical conditions are different in high-intensity lamps, of course, because the soft cores of low-intensity positive carbons resulted in craters less brilliant in their centers than in their outer regions. With high-intensity it is the other way around—the middle of the crater represents the thickest portion of the luminous ball of ionized gas, and this is much brighter than the glowing shell of the carbon itself.

Whether the screen be masked with black velour in the usual way or surrounded by a light-reflecting cove, the more evenly the picture is lighted, the better it will look. After all, vignetting can be done by the cameraman whenever it is required for dramatic emphasis.

One of the prime requisites for satisfactory 3-D is that the two superposed images of the stereo pair have the same brightness and light-distribution characteristics. If hot-spot lighting be inflicted upon 3-D, then the projectionist must take special pains to make the two hot-spots coincide — else patrons will begin wiping their Polaroid spectacles with the idea that popcorn hulls must have lodged thereon.

Balanced 3-D Lighting

It is extremely difficult to operate two arclamps at the same time and keep their light-output equal and constant. If the projectionist succeeds in keeping the brightness-difference under 5%, no one will notice any dissimilarity. Let the difference exceed 5%, and 3-D patrons will begin complaining that stereo movies are hard on the eyes. Minute structural differences in mirrors, carbons, and lenses can, and very often do, cause the two projectors of a pair to vary in light-output by as much as 10 or 15% either way. The possibility of the projectors becoming mismatched in light-output by a difference of from 20 to 30% is ever present in some-cases, although such great differences are rare. Spontaneous light-changes of from 10 to 15% are rather frequent, and in conventional projection entirely inconspicuous except when they occur during changeovers.

Many of these remarks apply to alterations in the color of the projected light.

If two screens are set up side by side and blank light projected upon them by two projectors, a brightness-difference of 5% is about the smallest that can be detected by human vision under these conditions. Observers have noticed conspicuous brightness-and color-differences in the three conjoined fields of Cinerama projection, hence it may be assumed that the brightness-differences greatly exceed 5% on occasion.

[THE END]

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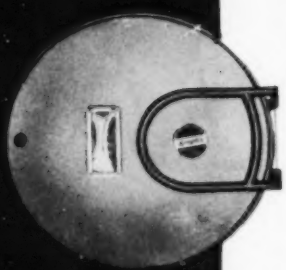

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